The Next Generation in Carbon Sequestration Solutions

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Relating to Section 5 on Offsets:
National Emissions Trading Taskforce Discussion Paper

An accurate and quantifiable method of terrestrial carbon sequestration for Australian Farmers, Landholders and other Land-Managers

Introduction

Australia has 20 million hectares under cultivation of grass crops annually, salinity affects a further 2.5 million hectares and grazing land exceeds both of these areas combined. Phytolith (or Plantstone) carbon sequestration is relevant to a wide range of plant types including those grown for agricultural crop production, grazing and the rehabilitation of degraded landscapes. The following method of offsets through Phytolith organic carbon (**PhytOC**) sequestration allows farmers **for the first time** to be included and **rewarded** for their efforts in **carbon abatement.** Significantly this may be achieved **accurately** without costly or approximate calculation processes required for monitoring soil carbon stocks themselves. Nevertheless, the contribution of soil carbon stocks does need to be recognised and introduced into any offset scheme perhaps using no-till calculations excepted under some carbon abatement schemes elsewhere. The **PhytOC** process involves a land-use change or, the intentional selection and replacement of one species or variety of a crop/plant to another for which the additionally of carbon sequestered can be scientifically verified and measured with a high degree of accuracy. Baseline data is accurately measured and easily monitored using the method proposed below. The concept is as follows:

The baseline measurement is taken for the existing plant type or the variety you would normally sow e.g. a wheat variety with e.g. a **Low** PhytOC sequestration capacity.

The additionality is achieved by selecting and then planting/sowing a plant type or variety e.g. a wheat variety with **High** PhytOC sequestration capacity.

The Verification is made by (1) using archived baseline data on the PhytOC storage capacity of specific varieties that we are currently making available or, (2) by sending samples of both existing and new plants/varieties to be tested at a suitably accredited laboratory at minimal cost to the producer/landholder using published methods (c.f. Parr and Sullivan 2005) and a standard carbon analyzer, where:

$$H - L = A$$

High % of PhytOC capacity (H), minus the **Low** % PhytOC capacity (L), equals the **Additional** carbon sequestered (A)

This method of PhytOC sequestration is compatible with existing guiding principles of good practice in a number of sections of the IPCC Guidelines c.f. section 3.1.2.3 “Other Managed Lands” and as footnoted under these guidelines “*National circumstances may necessitate slight* ***modifications to the pool definitions*** *used here. Where modified definitions are used, it is good practice to report upon them clearly, to ensure that modified definitions are used consistently over time, and to demonstrate that pools are* ***neither omitted*** *nor double counted*”.

Thus it can be interpreted from this statement that while it is very important that we stick to the intended principles of Kyoto and good practice guidelines under IPCC, the definitions themselves should be viewed as a guide rather than an absolute in order that important carbon pools not be excluded.

Keeping this in mind, in Chapter 5 of the National Emissions Trading Taskforce Discussion Paper dealing with offsets the main requirements set out are:

Consistency with international frameworks

NETS p66. It is proposed that approaches to facilitate the development of offset projects and the creation of offset credits under the NETS be as consistent as possible with those emerging methodologies, rules and frameworks being developed for the JI mechanism under the Kyoto Protocol.

As pointed out above the method of PhytOC sequestration is consistent with the principals of the Kyoto Protocol and compatible with existing guiding principles of good practice in a number of sections of the IPCC Guidelines.

Additionality

NETS p66-67. The key aim of an offsets regime is to provide an incentive for abatement that would not otherwise have occurred… This means that it is possible to identify what would be the most likely activity under the 'business as usual' scenario in a variety of sectors.

The **PhytOC** sequestration process requires a definite change from a business as usual scenario by the necessity to make a conscious decision to shift from the practice of growing a **Low** % PhytOC capacity variety or plant type (and in the case of e.g. degraded saline soils a **no** % PhytOC capacity) to intentionally introducing a plant type or variety with a **High** % of PhytOC capacity.

Baseline setting and monitoring

Along with published data an independent report outlining in more detail than can be provided here, on how the baseline setting and monitoring could be implemented for PhytOC was submitted to the NSW Greenhouse Abatement Scheme Administrator and IPART by the Australian Forest Corporation an accredited NSW Greenhouse Abatement Certificate Provider. However, briefly as outlined above the baseline measurement is easily taken for the existing plant type or the variety you would normally sow. This information might be retrieved from archived information on the PhytOC capacity or by submitting the sample to a suitably qualified laboratory and assessed using published internationally excepted standard methods of carbon (PhytOC) quantification (c.f. Parr and Sullivan 2005).

Field trials

The annually reported yields in the fodder, grain and other varieties that we have found to date to contain high PhytOC have been equal to or up with the best yeilders for the season particularly for sugarcane and sorghums. Thus there is no need to experience a loss in yield or mass for the land manager simply a decision to improve carbon sequestration rates by selecting a high **PhytOC** capacity variety.

For example in sugarcane field trials in northeastern NSW the 'additional' soil carbon sequestration rate for the high PhytOC yielding sugar cane variety over the low PhytOC yielding sugar cane varieties was the equivalent of ~0.4 tonne eCO_2 $ha^{-1}yr^{-1}$. In field trials on sorghum at Tamworth NSW we had seven varieties growing in the same soil and, of those varieties two were found to have exceptionally high **PhytOC** levels. The best of these had a **PhytOC** capacity ten times that of the average variety grown and was reported in one season to have the highest harvest yields at two sites in Queensland.

Note: ***The PhytOC sequestering method may be used in conjunction with other proposed procedures for carbon abatement such as increased ground cover and no-till farming. For agricultural crops the PhytOC component that is measured is in the post-harvest stubble thus there is no loss in grain production etc.***

A brief explanation of the science behind the PhytOC carbon sequestration concept is as follows:

(a) All grasses contain silica Phytoliths (or Plantstones) in their outer (epidermal) cells, this is a natural plant trait (Bozarth, 1992; Brown, 1984a; Brown, 1984b; Clifford and Watson, 1977; Fredlund and Tieszen, 1997a; Krishnan et al., 2000; Krull et al., 2003; Lentfer et al., 1997; Mulholland and Rapp, 1992b; Ollendorf et al., 1988; Parr, 2004; Parr and Sullivan, 2005b; Piperno and Pearsall, 1998; Thorn, 2004; Twiss, 1992; Twiss et al., 1969).
(b) The silica entombs cellular material comprised of carbon that has been identified using a number of methods (Allmaras and Albrecht, 2006; Boyd and Lentfer, 1995; Fredlund and Tieszen, 1997b; Golchin et al., 1994; Houyuan. et al., 2000; Kelly et al., 1991; Krull et al., 2003; Parr and Sullivan, 2005b; Piperno, 1998; Wilding, 1967; Wilding et al., 1967).
(c) When a plant dies and decays or, it is harvested and the stubble is left in the paddock, the silica Phytoliths are incorporated into the soil matrix c.f. (Allmaras and Albrecht, 2006; BOWMAN et al., 2004; Boyd and Lentfer, 1995; Fredlund and Tieszen, 1997b; Golchin et al., 1994; Houyuan. et al., 2000; Kelly et al., 1991; Krull et al., 2003; Parr and Sullivan, 2005b; Piperno, 1998; Wilding, 1967; Wilding et al., 1967).
(c) Silica Phytoliths are durable and can take thousands of years to brake down in soils (Albert et al., 2000; Allmaras and Albrecht, 2006; Bowdery, 1989; Bowdery, 1996; Boyd, 1999; Boyd et al., 2005; Boyd et al., 1998b; Kealhofer and Piperno, 1994; Parr, 2003; Parr and Carter, 2003; Parr et al., 2001; Pearsall, 1989; Pearsall, 1999; Pearsall and Trimble, 1984; Piperno, 1994; Piperno, 1985; Piperno, 1998; Piperno et al., 2000).
(d) This carbon entombed in silica Phytolith cells is, as a result, sequestered for the long-term demonstrated by radiocarbon dating the Phytoliths themselves (**c.f. 8,000-12,000 years** (Mulholland and Prior, 1993; Parr and Sullivan, 2005a; Parr and Sullivan, 2005b; Sullivan and Parr, 2005; Wilding, 1967; Wilding et al., 1967)
(e) The amount of carbon locked up by each species and/or variety of a crop or grass, varies significantly. Thus, if you choose a higher yielding PhytOC variety over a lower yielding variety you presumably fulfill the additionally clause requirement by the IPCC (Kyoto) guidelines for carbon abatement (Parr, 2003; Parr and Sullivan, 2005a; Parr and Sullivan, 2005b; Sullivan and Parr, 2005).
(f) The beauty of this method is that you only need to test the plant varieties for the baseline PhytOC content rather than the soils themselves, which is cheap, easy, quick and very accurate.
(g) Unlike other carbon fractions currently approved and measured PhytOC carbon is resistant to decomposition, fire and oxidation under most natural conditions.

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